Chapter IV

Energy Efficiency and Renewable Energy

Overview

Mexico has abundant reserves of petroleum and natural gas, yet the energy sector is facing important challenges. Strong economic and population growth is causing demand for natural gas and electric energy to outpace the country's ability to generate and deliver additional supply. Lack of investment capital for major energy infrastructure constrains major infrastructure projects like natural gas pipelines, transmission lines, and power plants and prevents electricity-generating capacity from matching the pace of expanding electricity demand. According to the U.S. Department of Energy, shortages in Mexico of electricity are predicted for as early as 2003.[1] As a result, the Mexican government's attention is turning toward private-sector funding. Mexico and the United States are working to improve their energy ties. Planned power plants could also help satisfy the energy needs both for northern Mexico and Southern California. Cross-border ties with Southern California are very important for Baja California because it is isolated from the Mexican national electric grid. Such is the case for the state of Baja California Sur as well.

While the total generation capacity for electricity in Baja California was about 2,115 MW in 2000, Baja California Sur generated only 342 MW. Given the enormous increase in demand for electricity, this level of installed capacity will not be sufficient in the future. As such, the market for electric power generation is one of the strongest in the peninsula. It offers many opportunities for firms that provide solutions for improving energy efficiency and renewable energies. The continued liberalization of investment rules for the energy sector should increase these opportunities even more.

Energy Production and Consumption

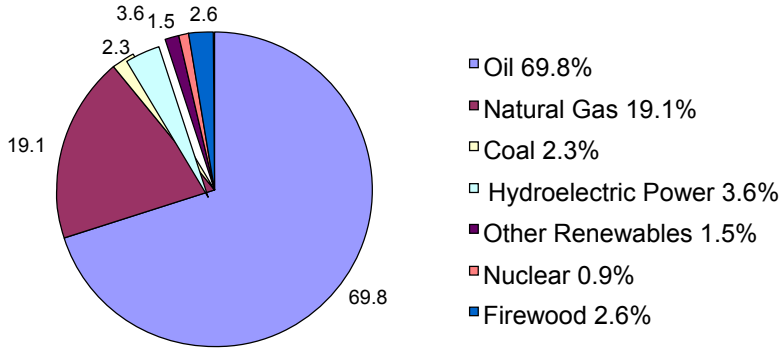

Figure 1: Energy Produced in Mexico in 2000[2]

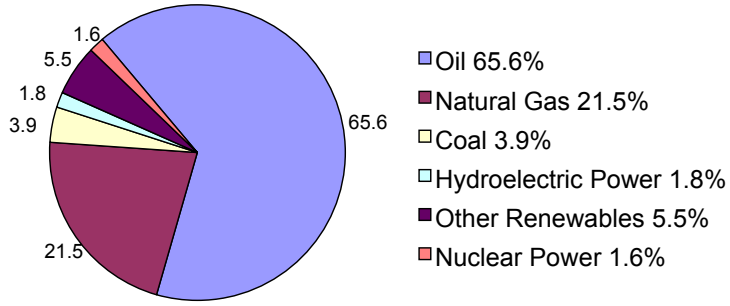

Figure 2: Energy Consumed in Mexico in 1999[3]

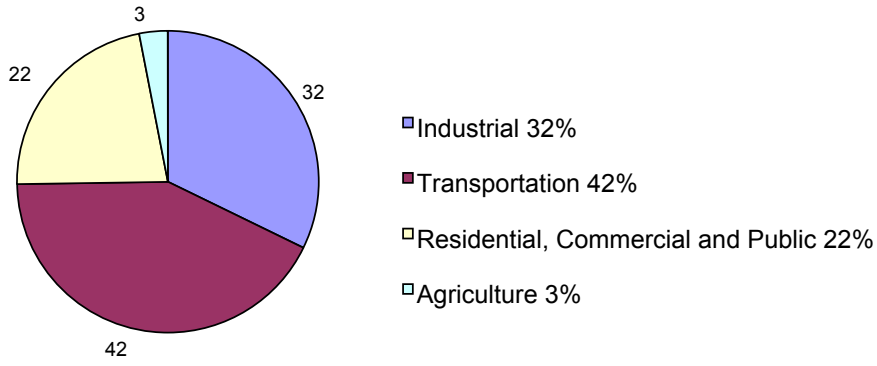

Figure 3: Sectoral Energy Use in Mexico in 2000[4]

Mexico's Energy Policy

According to analyses by the U.S. Department of Energy, Mexico's energy policy has three main objectives: (1) to achieve a rapid and efficient *expansion* of the energy sector; (2) to promote key *investment* for long-term growth with strong private participation; and (3) to strengthen and improve the *efficiency* of public-sector enterprises. A main focus is on expanding the natural gas market and reducing reliance on fuel oil. It is Mexico's official policy to make natural gas its principal source of fuel in the future, which is supported by legal reforms published in November 1995. The reforms allow the private sector to build, operate, and own facilities for the distribution, storage, and transportation of natural gas.[5]

According to the Mexican Ministry of Energy (Secretaría de Energía–SENER), natural gas has several advantages: (1) it is a relatively cheap fuel; (2) the combustion is complete and clean, producing almost no sulfur dioxide; (3) the operation is secure; and (4) it is more energy efficient, especially if combined-cycle technology is used.

Like the oil and natural gas sector, liberalization of Mexico's electric power industry has begun, although on a limited basis. While the transmission and distribution of electric current is still reserved for the public sector, power generation is now open to private investors. By 2002, the Mexican Energy Regulatory Commission (Comisión Reguladora de Energía–CRE) had issued 192 private-sector permits nationwide.[6] In the years from 1995 to 2000, the private-sector share of Mexico's total electricity production rose from 5.5 percent to 6.3 percent.[7] Recently, there has been a significant expansion of electric generation capacity in Mexicali with initiation of plant construction by Sempra Energy and InterGen Energy, Inc. The InterGen facility will be a 1,065 MW natural gas-fired, combined-cycle facility that will sell 66 percent of its capacity to Mexico's Federal Electricity Commission (Comisión Federal de Electricidad–CFE) and the rest will be for export to California. The Sempra facility will be a

gas-fired, combined-cycle plant with 600 MW capacity. Both plants are expected to come on line in 2003.

As Mexican generating capacity will need to increase by 13,529 MW within the next few years, additional projects will be developed. The CFE recently announced an Independent Power Producer (IPP) tender for an electrical power generation facility of 220 MW capacity in Mexicali. Another CFE tender calls for the construction of an internal combustion power plant with a total capacity of 37.5 MW. The designated site for this diesel power plant is near La Paz, Baja California Sur.[8]

Plans and Projects

Although oil is still Mexico's number one energy source, priority is now given to the development and use of natural gas reserves. Plans exist to increase natural gas transmission within and across Mexico's northern border. There is also an effort nationally to concentrate more on gas exploration and production. The gas industry is regulated by the CRE. However, compared to the oil industry, the natural gas sector is less constrained, which allows private companies into the downstream sector. The most active foreign investors in the natural gas sector are European companies. Sempra Energy is currently the most active U.S. company in Mexico's gas market.

Renewable energy sources remain only a small part of the energy mix in Mexico. However, there are many opportunities to exploit the use of renewable energy technologies in Mexico. Such strategies, combined with an expansion in the natural gas market, could also considerably decrease Mexico's CO_2 production and help reduce levels of air pollution. Mexico has abundant solar and wind resources that could be utilized, but the most important renewable energy source is hydroelectric generation.

Improving energy efficiency is another approach to addressing the problem of rising demand and insufficient production. Mexico has a number of energy conservation agencies, including the National Commission for Energy Savings (Comisión Nacional para el Ahorro de Energía–CONAE) and the Trust

Fund for Electric Energy Savings (Fideicomiso para el Ahorro de Energía Eléctrica–FIDE). CONAE is an independent entity within the Ministry of Energy serving as a consulting body to federal and municipal organizations. FIDE, a private non profit agency, was founded in 1990 to introduce and promote the conservation and efficient use of electric energy.

Energy efficiency and the development of renewable energy generation is not just an issue with regard to the environment. According to CONAE, Mexico's fossil fuels will not last much longer than 40 years if consumption remains at the current level.[9] CONAE and FIDE are supported by the Alliance to Save Energy, an organization that helps Mexican enterprises reduce energy costs, increase productivity, and decrease pollution. The Alliance also published a directory to serve as a networking guide for those interested in implementing energy-saving projects and locating suppliers for the Mexican market (www.ase.org/directoriomexico). On the state level, the Baja California division of the Energy Conservation Program for the Electric Sector (Programa de Ahorro de Energía del Sector Eléctrico–PAESE) is launching programs to save electric energy. According to Ing. Agustín Lara Vela of CFE-PAESE, some companies have reduced their annual energy use by as much as 14 percent.[10]

According to CONAE, more than five million Mexicans have no access to electricity from the national power grid. Renewable energies could be an economical option for those who lack access to the main grid, especially in rural areas, because of incentives created by various government programs. As part of Mexico's Rural Alliance (Alianza para el Campo) program, farmers are encouraged to convert to renewable energy technologies. Farmers receive proportionally larger grants for the purchase of renewable energy systems than for similar systems that are based on fossil fuel. The U.S. Sandia National Laboratory also supports the installation of renewable energy technologies. In 1994, it established the Mexico Renewable Energy Program (MREP). The program provides training and technical assistance as well as financial support. So far, Sandia has installed more than 250 water-pumping stations operated by

solar or wind power as well as 150 other renewable energy projects in 14 Mexican states. One such system was installed in Baja California and 47 others in Baja California Sur. Sandia works with the Mexican government, renewable energy suppliers in the United States and Mexico, universities, and other partners. These programs not only help to develop infrastructure in Mexico's underdeveloped rural areas, but also reduce pollution from fuel-powered generators and broaden the renewable energy market outside the United States. Due to programs like the MREP and Rural Alliance, Mexico's photovoltaic water-pumping market has expanded. At the same time, however, it has become very competitive and profit margins are lower than they used to be.

Natural Gas and Renewable Energy Generation in the Baja California Peninsula

Natural Gas

The natural gas transmission pipeline network is not well developed in Baja California or Baja California Sur, although a number of proposals are underway to expand this infrastructure. In northwestern Mexico, the only injection points are at Mexicali and Tijuana. Two gas turbine power plants fueled by natural gas are located in Rosarito and Tijuana and two more are under construction by Intergen and Sempra in Mexicali. There is no distribution of natural gas in the southern peninsula. Given growing demand, the Mexican Petroleum Company (Petróleos Mexicanos–PEMEX) is expected to expand its infrastructure in the Mexican-U.S. border region.

Sempra Energy Resources, based in San Diego, is building a 600-MW natural gas-fired power plant in Mexicali (Termoeléctrica Mexicali) because of its proximity to the North Baja Pipeline, which is under construction. Intergen is also building a natural gas-fired power plant complex in Mexicali of 1,079 MW capacity. In addition, Sempra Energy is planning to build a liquefied natural gas (LNG) receiving terminal near Ensenada to help Mexico keep up with the region's growing demand for natural gas.

Several other companies have also announced plans to construct LNG terminals in Baja California. In early August 2002, Marathon Oil submitted a permit application to build an LNG project in southern Tijuana. Other partners in the project include: Pertamina, Indonesia's state-owned oil company; Golar LNG, a Norwegian firm; and Grupo GGS, a Mexican development company. The project would include an LNG re-gasification plant that would produce one billion cubic feet of natural gas per day, a pipeline to transport the gas, and a desalination plant that would treat a capacity of 20 million gallons of potable water per day.[11]

Other partnerships to build LNG facilities have been announced, but have not yet applied for permits to develop the projects. In addition to the Sempra project mentioned earlier, Phillips Petroleum and El Paso Corporation, Royal Dutch Oil/Shell, and Chevron Texaco are competing to launch LNG projects in Baja California.[12] The projects face community opposition and concerns about environmental and safety impacts. However, developers argue that the projects would prepare the region for future energy needs. Only one pipeline is needed to satisfy current demands for the region. While the outcome is not yet clear, if one or more of these plans does move forward, opportunities will be created for technology and service suppliers.

Hydroelectric Generation

According to the CFE, hydroelectric electricity generation accounts for about 17 percent of Mexico's total electricity generation. Baja California and Baja California Sur have no large hydroelectric power plants, but there is a small plant of about 20 MW capacity under construction near Tecate to take advantage of water flows from the aqueduct that transports Colorado River water to Tijuana. Due to the region's climatic conditions—approximately 95 percent of the peninsula is classified as dry or very dry[13]—its hydroelectric potential is minimal.

Geothermal Generation

In the past, geothermal energy has represented the most utilized sector of renewable energy sources in Mexico. Mexico's first and largest geothermal power plant is located near Mexicali. The Cerro Prieto plant includes four units that produce 720 MW, or about 80 percent of Mexico's total capacity for geothermal power generation. A smaller geothermal facility of 30 MW is located in the northern part of Baja California Sur at Tres Vírgenes, near the city of Santa Rosalía.

Wind Power

According to SENER, there is great potential for wind-generated energy in San Quintín, Baja California, which could present investment opportunities for U.S. companies. Although wind power accounts for a very small percentage within the total energy production, it should be noted that its share has consistently been on the rise. In the 2001–2006 Sectorial Program for Energy (Programa Sectorial de Energía, 2001–2006), the CFE noted the generation of 1.7 MW by wind power in La Ventosa and Guerrero Negro as one of their outstanding projects. A private project by Fuerza Eólica del Istmo in La Ventosa includes the construction of a wind park with a capacity of 30 MW. Fuerza Eólica del Istmo has also applied for permits for the construction of four more wind power facilities, of which three would be located in the Baja California peninsula.

Solar Energy

CFE is currently working on two different projects related to solar energy. The first is conducted in collaboration with the Institute for Electrical Research (Instituto de Investigaciones Eléctricas–IIE). The IIE is in charge of collecting information from four different types of solar panel systems installed in four houses in the Mexicali area. The goal of this project is to compare the different solar panel systems and to evaluate their capacity in the context of local climatic conditions in Baja California (dust, extreme heat, storms, etc.). The second ongoing project, located in San Juanico, Baja California, also involves these different systems.[14]

Solar energy is widely used throughout the peninsula in rural areas and small towns that are not connected to an electrical grid. Many vacation homes along both the peninsula's Pacific and Gulf coasts use solar panels for lighting, communications, and appliances such as refrigerators. Fishing cooperatives have also installed solar-based systems in isolated fishing camps in Baja California and Baja California Sur. In some cases, these systems have significantly reduced the use of diesel generators.

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[14] Both projects are coordinated by Arq. Laura Morales Sosa, head of CFE's department for energy savings. She can be contacted at (52–686) 554–8760 or via email at <laura.morales@cfe.gob.mx>.
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